

REMARKS

Entry of the foregoing amendment and favorable reconsideration of the subject application in the light thereof, and in the light of the following remarks, are respectfully requested.

By the present amendment, claim 18 has been added in order to round out the scope of protection to which Applicant is entitled. It is submitted that proper support for the claim is found in the original application as filed, e.g., paragraph 14, on page 4 of the specification, line 14.

Turning now to the outstanding rejection of record, the Examiner has withdrawn all previously made rejections, which is acknowledged with appreciation by Applicant. However, the Examiner has now rejected claims 1-9 and 15-17 under 35 U.S.C. §103 as being unpatentable over *Geibel et al.* (U.S. Patent No. 4,814,224). For the following reasons, however, the Examiner's rejection is most respectfully traversed by Applicant.

The *Geibel et al.* patent reference does not suggest or disclose the use of poly(phenylene sulfide) as the binder for a non-woven web comprised of metal or refractory fibers. There is no suggestion or motivation from reading *Geibel et al.* to employ poly(phenylene sulfide) as the binder for metal or refractory fibers. One of ordinary skill in the art reading *Geibel et al.* would in no manner come away from such a reading with any expectation that poly(phenylene sulfide) could be successfully used as a binder for metal or refractory fibers.

Rather, *Geibel et al.* uses a poly(arylene sulfide ketone) resin as a matrix polymer, which is compression molded into a sheet. Note column 4, lines 33-34 of *Geibel et al.*, wherein it is noted that compression molding produces sheets that are

rough, continuous and increasable. The Examiner is correct that *Geibel et al.* does discuss fiber reinforcement of the resin sheets, and that such fiber reinforcement can include inorganic materials and carbon fibers, as well as metal fibers. However, the fibers are merely reinforcement, and as noted at column 4, lines 35 to 37, the thickness of the resin sheet is selected to provide sufficient resin to wet out the fiber reinforcement to yield a continuous resin matrix.

The difference is clear to the skilled artisan. The *Geibel et al.* patent discusses a polymeric sheet having fiber reinforcement. To the contrary, the present invention recognizes that poly(phenylene sulfide) can be successfully used as a binder for a non-woven sheet comprised of metal or refractory fibers. The non-woven sheets of the present invention, such as claimed in claims 15-17, can be used for the properties of the fibers of the non-woven sheet, which sheet is bound together by a polyphenylene binder. One of ordinary skill in the art reading *Geibel et al.*, with its description of a polymeric matrix which may be reinforced, would not be directed to using the same in place of a non-woven sheet as an electrode or in a fuel cell. The matrix of *Geibel et al.* encapsulates the entire fiber reinforcement such that the properties of the fibers themselves could not be employed in the fuel cell or as the electrode. This is a major difference between using the polymer as a matrix polymer and simply as a binder in accordance with the present invention. The present invention recognizes, as *Geibel et al.* does not, that poly(phenylene sulfide) can act suitably in difficult environments as a binder to continue to hold together a non-woven sheet made of metal or refractory fibers. There is no such suggestion in *Geibel et al.*

A major difference between the use of a polymer as a matrix polymer and the use of a polymer as a binder, can be seen in the relative amount of the polymer generally employed. With regard to a polymer matrix, the amount of reinforcement fibers employed is generally a minor amount compared to the amount of polymer. Note for example, Example 5 of *Geibel et al.*, lines 20-23, wherein it is noted that the composites contain 17 and 21 weight percent carbon fiber. To the contrary, when the polymer is used as a binder, it is generally present in a minor amount relative to the fibers of the non-woven web. As discussed in the specification of the present application, the amount of poly(phenylene sulfide) that is generally present as a binder is less than 20 weight percent. Newly added claim 18 recites that the amount of poly(phenylene sulfide) present in the non-woven web ranges from 3 to 20 weight percent. Use of the poly(phenylene sulfide) in such a minor amount, as a binder, is simply nowhere suggested in *Geibel et al.*

A further difference is apparent to the skilled artisan when one considers how a polymer matrix sheet is formed vis-à-vis how a polymer is employed as a binder. When employing the polymer as a polymer matrix, compression molding is used to form the sheet, i.e., a sheet of the polymer itself. When the polymer is to be used as a binder, the polymer is generally added to a furnish comprised of the base fibers to be used in creating the non-woven sheet, e.g., metal fibers or refractory fibers, and then the sheet or web is formed from the furnish. Once the sheet has been formed, the sheet is then heated to a temperature sufficient to melt the poly(phenylene sulfide) such that the polymer can melt around the interstices of the base fibers used to construct the non-woven sheet, and thereby bind the base fibers into a non-woven, but integral structure. See, paragraph 19 of the present specification. This

difference in formation of the final product emphasizes the difference of the role of the polymer when it is used as a "matrix" polymer and when it is used as a binder as in the present invention.


Accordingly, it is respectfully submitted that *Geibel et al.* in no manner suggests Applicant's claimed invention. Favorable reconsideration and withdrawal of the Examiner's rejection of claims 1-9 and 15-17 under 35 U.S.C. §103 are therefore respectfully requested.

From the foregoing, further and favorable action in the form of a Notice of Allowance is believed to be next in order, and such action is earnestly solicited.

Respectfully submitted,

BUCHANAN INGERSOLL PC

Date: February 6, 2006

By: 
E. Joseph Gess
Registration No. 28,510

P.O. Box 1404
Alexandria, Virginia 22313-1404
(703) 836-6620